Chapter 3 – Prenatal Health

According to the Life Course Model, critical periods exist during the life course, when a positive or negative factor has a stronger effect on an individual's health trajectory than it would during other developmental periods.[1] The prenatal time frame is one such critical period. The status of a woman's health both before she becomes pregnant and during her pregnancy can exert a long-term impact on the infant and child. Prenatal health focuses on the period during pregnancy when women are encouraged to manage their health conditions, modify health behaviors and access prenatal care.

Section 1: Prenatal Care

First Trimester Care

Healthy People 2010 Objective 16-6a recommends that 90 percent of pregnant women enroll in first trimester prenatal care. Colorado is not meeting this goal, experiencing a decline in this measure for over a decade. In 2008, only 76.9 percent of pregnant women received first trimester care, compared to 80.7 percent in 2000 (Figure 9). Colorado's highest percentage of first trimester prenatal care was achieved in 1997 when 82.9 percent of all women reported early enrollment.[2] The national average reached 83.7 percent in 2006 (the latest available national data).[3]

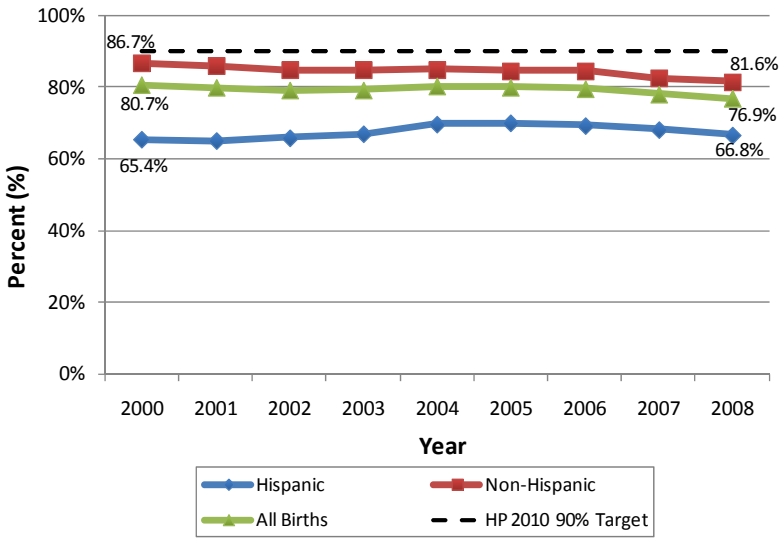


Figure 9. Percent of Births with First Trimester Care
Colorado Residents by Ethnicity, 2000-2008
Source: Colorado Department of Public Health and Environment, Birth Certificate Data

Figure 9 also compares first trimester care for Hispanic women (all races), and non-Hispanic women (all races), who gave birth between 2000 and 2008.[xiii] Non-Hispanic women

[xiii] Unless otherwise noted, data in this chapter describing "Hispanic" births are births to women of all races whose ethnicity is Hispanic. Births to "non-Hispanic" women are births to women of all races whose ethnicity is not Hispanic.

demonstrated a fairly steady drop in early care over the nine-year period, starting with 86.7 percent in 2000, and ending with only 81.6 percent in 2008. The pattern for Hispanic women was slightly different, with nearly five percentage points of improvement in first trimester care noted between 2000 and 2005, from 65.4 percent to 70.0 percent, with a subsequent decline to 66.8 percent in 2008.

According to the Colorado Pregnancy Risk Assessment Monitoring System (PRAMS) data from 2005-2008, 54 percent of all women had private insurance for prenatal care, 36 percent had public insurance, 8 percent paid expenses themselves, and 2 percent reported other sources. These figures differed significantly for Hispanic and non-Hispanic women, as shown in Figure 10. Two-thirds of non-Hispanic women were covered by private insurance, but the majority of Hispanic women (55 percent) were covered by public insurance.

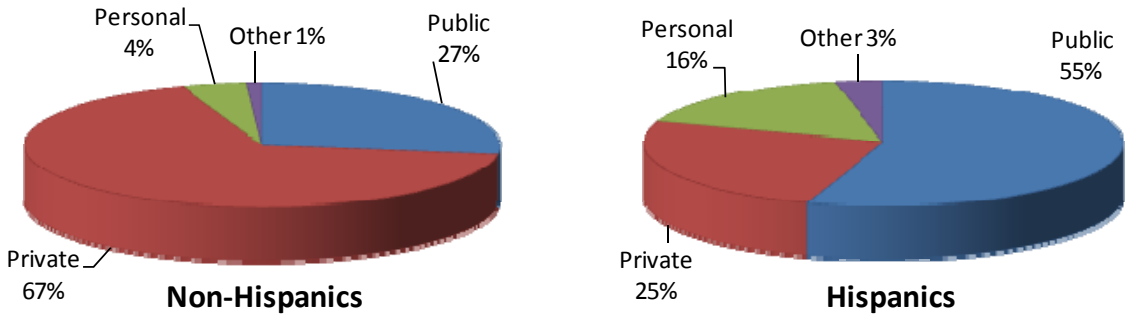


Figure 10. Percent of Pregnant Women by Ethnicity and Type of Prenatal Care Insurance, Colorado Residents, 2005-2008

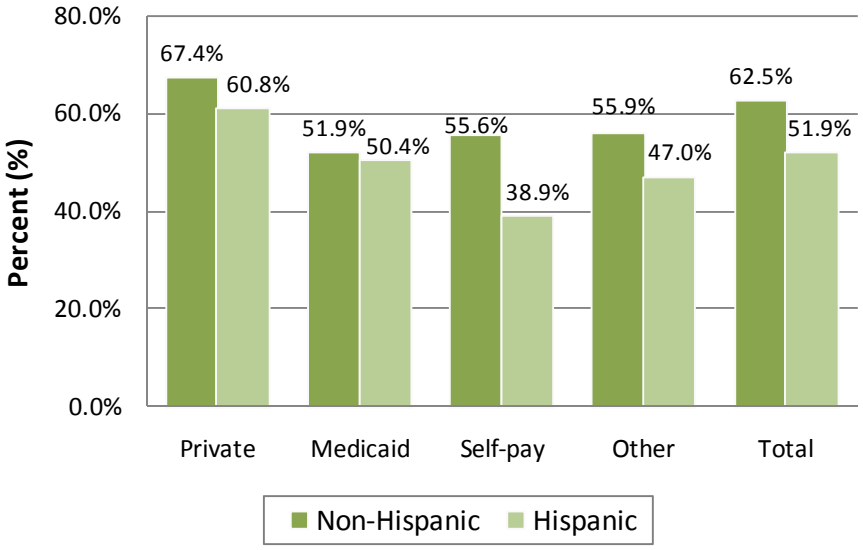
Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Adequate Prenatal Care throughout Pregnancy

While first trimester enrollment is a general indicator of access to care, "adequate prenatal care" is a better measure of appropriate care because it incorporates both early care and a consistent number of prenatal visits into the definition. In general, the percentage of women who receive adequate prenatal care throughout their pregnancy is lower than the percentage with first trimester care, since women may obtain a visit early in gestation, but may not obtain all recommended visits during pregnancy.[4] Healthy People 2010 Objective 16-6b proposes that 90 percent of pregnant women receive adequate prenatal care (the same as first trimester care).[5]

Among all women in 2007-2008 who had private insurance coverage for delivery (about half of all deliveries), just 2 out of 3 women (66.4 percent) received adequate prenatal care. The percentages for other types of insurance are even lower: when Medicaid covered deliveries (about one-third of all deliveries), just half (51.1 percent) received adequate prenatal care, and where "self-pay" was reported as the source of coverage, 47.6 percent demonstrated adequate prenatal care. When Hispanic ethnicity was considered (Figure 11), the percentages dropped: 60.8 percent of Hispanic women with private insurance obtained adequate care, compared to

67.4 percent of non-Hispanic women, and 38.9 percent of Hispanic women who reported "self-pay" obtained adequate care, compared to 55.6 percent of non-Hispanic women. These differences are significant. Among women with Medicaid coverage, however, about half of both non-Hispanic and Hispanic women obtained adequate prenatal care, a non-significant difference.



(Note: Self-pay describes 5 percent of all women; Other describes 7 percent.)

Figure 11. Percent of Women Receiving Adequate Prenatal Care by Type of Insurance at Delivery, and Ethnicity, Colorado Residents, 2007-2008
Source: Colorado Department of Public Health and Environment, Birth Certificate Data

Hispanic women who are not U.S. citizens and who are also undocumented do not qualify for public programs that pay for prenatal care; therefore, they tend to have low rates of adequate prenatal care, thus influencing this measure. For this population, Emergency Medicaid is the only public benefit available to cover the costs of labor and delivery. An estimated 1 in every 10 Colorado births occurs to a woman who receives only Emergency Medicaid coverage.

The percentage of women receiving adequate prenatal care varies by county and region. This figure is influenced most by the availability of health care and the level of education and income within the county. Figure 12 illustrates the percentage of mothers who received adequate care during 2007-2008 by county. There were only six counties where 75 percent or more of mothers received adequate prenatal care: Clear Creek, Douglas, Gilpin, Kit Carson, Logan, and Pitkin. In 20 counties, less than half of pregnant residents received adequate prenatal care (most of these had a small population, with the exception of El Paso and Mesa). In addition, the map shows differences regionally. Lower proportions of women receive adequate care in the east central, south central and western parts of the state.

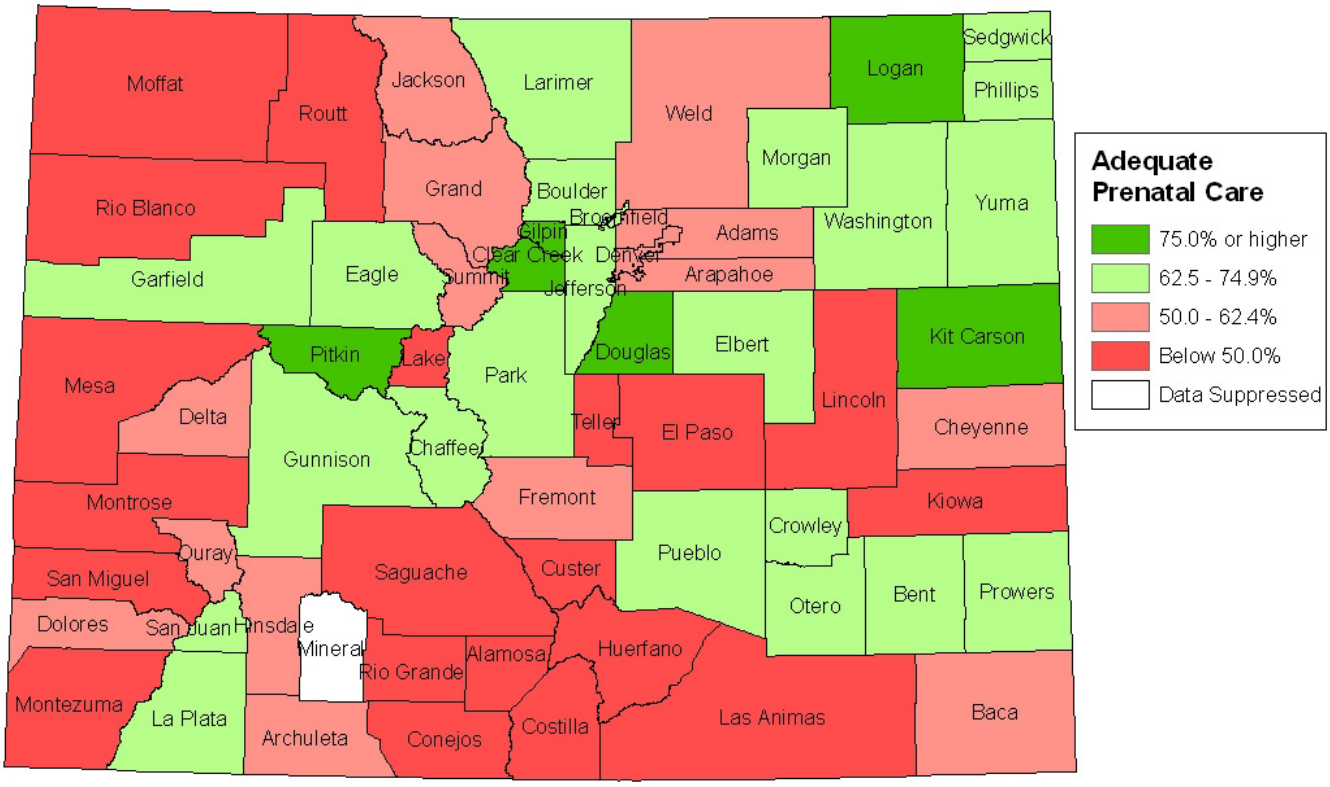


Figure 12. Percent of Pregnant Women in Colorado Receiving Adequate Prenatal Care, by County of Residence, 2007-2008
Source: Colorado Department of Public Health and Environment, Birth Certificate Data

Oral Health Care

Addressing oral health during pregnancy is an important component of prenatal care. Although not well understood, periodontal disease (a disease of the gums and tissues around the teeth and bone) and poor oral health appears to be associated with adverse birth outcomes such as preterm birth, low birth weight, and preeclampsia, according to several studies since 1996.[6-10]

A 2001 study published in the Journal of the American Dental Association concluded that the risk of delivering early was greater for women with severe or generalized periodontal disease:[6]

- Delivery before 37 weeks was 4 times greater;
- Delivery before 35 weeks 5 times greater;
- Delivery before 32 weeks was 7 times greater.

The National Health and Nutrition Examination Survey determined that during 1999-2004, 6.4 percent of women between the ages of 20 and 64 years old reported periodontal disease, with more than half these women exhibiting moderate or severe periodontitis. Data are not available for women of reproductive age (ages 15-44 years old) but for men and women ages 20-34 years old, the rate was 3.8 percent. Higher rates of periodontal disease are associated

with male gender, low income, low education, smoking and older ages. Among women ages 35-44 years old, the rate of destructive periodontal disease was 11.9 percent, and among all persons below 200 percent of the federal poverty level (FPL), it was 28 percent.[11]

PRAMS data for 2005-2008 provide some information on the status of oral health care for pregnant women. Only 37 percent of women reportedly had their teeth cleaned during pregnancy: 49 percent had private health insurance, compared to 20 percent with public insurance. Further, only 42 percent of pregnant women reportedly had a health care worker advise them about proper oral health care during pregnancy. Forty-eight percent of women with private health insurance received this type of information, compared to 35 percent with public insurance (Figure 13).[xiv] The low percentages suggest that oral health care is not a standard component of ongoing prenatal care.

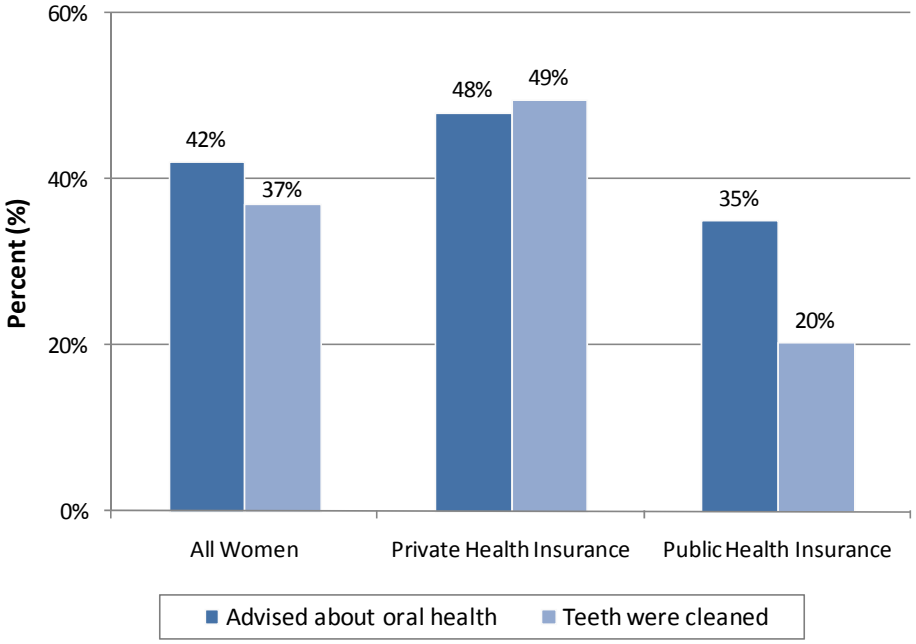


Figure 13. Percent of Pregnant Women Advised About Oral Health and Getting Teeth Cleaned During Pregnancy, by Type of Health Insurance, Colorado Residents, 2005-2008
Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

During 2005-2008, 21 percent of pregnant women reported problems with their teeth, requiring dental care. The percentage among low-income women (at or below 200 percent FPL) was nearly double that of higher income women (above 200% FPL) —28 percent compared to 16 percent. Among women reporting that they had an oral health problem and needed to see a dentist, a slight majority (57 percent) sought and received care. However, this proportion varied greatly by income, as shown in Figure 14. Among women at or below 200% FPL, just half saw a dentist, compared to nearly three-quarters (73 percent) of women above 200% FPL.

[xiv] PRAMS does not include data on dental insurance; therefore, health insurance was used as a simple proxy.

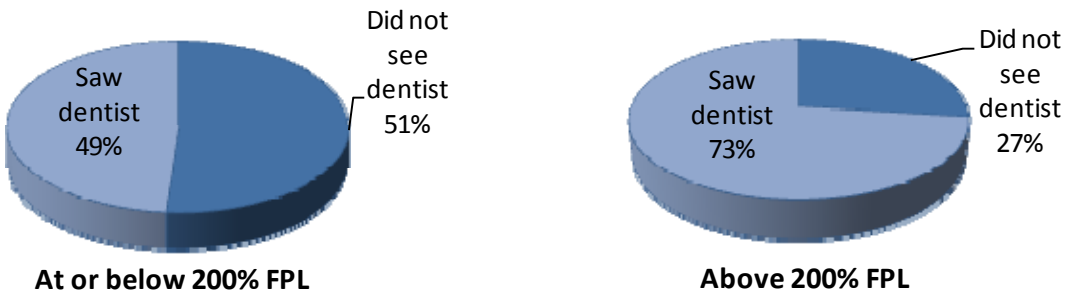


Figure 14. Percent of Pregnant Women by Poverty Level Needing to See a Dentist By Whether They Obtained Care, Colorado Residents, 2005-2008

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Section 2: Maternal Morbidity

Diabetes

It is important that women with type 1 or 2 diabetes (non-gestational), be diagnosed as early as possible, because they are at increased risk for delivering an infant with birth defects.[12] Although the prevalence of pre-pregnancy diabetes and gestational diabetes is low among pregnant women in Colorado, complications from diabetes are common. Colorado PRAMS data from 2005-2008 show that just over 1 percent of all pregnant women reported being diagnosed with diabetes prior to pregnancy. The prevalence of pre-pregnancy diabetes was two times higher among Hispanic women (2 percent) compared to non-Hispanic women (1 percent), a statistically significant difference (Figure 15).

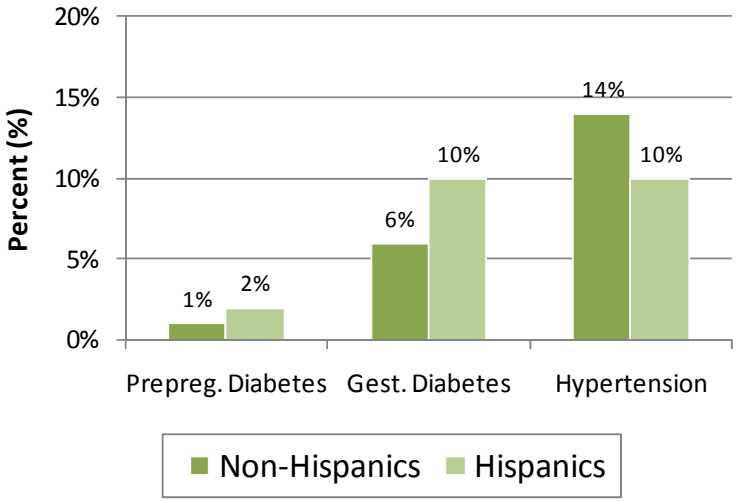


Figure 15. Percent of Pregnant Women Reporting Diabetes or Hypertension by Ethnicity, Colorado Residents, 2005-2008

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Gestational Diabetes

The risk of having a baby born with birth defects is lower among women who are diagnosed with gestational diabetes, than those with pre-existing diabetes; however, gestational diabetes puts women and their infants at risk for other health issues such as preeclampsia, premature birth, cesarean section delivery, and large for gestational age infants. According to 2005-2008 PRAMS data, 7 percent of pregnant women in Colorado were diagnosed with gestational diabetes. The prevalence of gestational diabetes was significantly higher among Hispanic women (10 percent), than among non-Hispanic women (6 percent) (Figure 15). Lifelong risks associated with gestational diabetes include development of type 2 diabetes in the mother, and glucose intolerance and obesity in the child.[13] Healthy People 2010 Objective 5-8 proposes to reduce the proportion of pregnant women with gestational diabetes.

Hypertension

Pregnancy-related hypertension is associated with poor birth outcomes that include increased risks for prematurity, cesarean delivery, acute renal dysfunction, placental abruption, chronic hypertension, respiratory distress syndrome, and fetal growth restriction in the infant.[14-18] The PRAMS survey asks women if they experienced high blood pressure, hypertension, preeclampsia or toxemia during pregnancy. For the period 2005-2008, 13 percent of women responded affirmatively. Fourteen percent of the non-Hispanic women (all races) had hypertension, a significantly higher proportion than the 10 percent of Hispanic women (all races) with hypertension (Figure 15). Unlike gestational diabetes, which affects Hispanic women more than non-Hispanic women, hypertension is more likely to affect non-Hispanic women, including Black/African American women.

Injury

There are no Healthy People 2010 or 2020 objectives related to injury that are specific to pregnant women. However, serious injuries of concern to pregnant women include car crashes and physical abuse.[19-20] PRAMS data for 2004-2007 indicate that between 1 and 2 percent of pregnant women are involved in car crashes. Research shows that wearing a seatbelt decreases injury for the mother and significantly reduces the possibility of fetal death. Data also indicate that pregnant women believe that seatbelt usage may injure the fetus during a crash, a misconception that must be addressed.[21] PRAMS data indicate that information regarding proper seatbelt usage during pregnancy was communicated to just over half of all pregnant women (56 percent in 2007), and has not increased in recent years.

An estimated 3 percent of women report some form of physical abuse during the year before delivery (PRAMS, 2005-2008). The definition of physical abuse includes being pushed, hit, slapped, kicked, choked or physically hurt by a former or current partner. Abuse occurs significantly more often among women younger than 25 years old (5 percent), compared to women ages 25 years and older (2 percent) (Figure 16). It is equally common among Hispanic and non-Hispanic women in these two age groups; the difference between the two groups younger than 25 years old is not statistically significant.

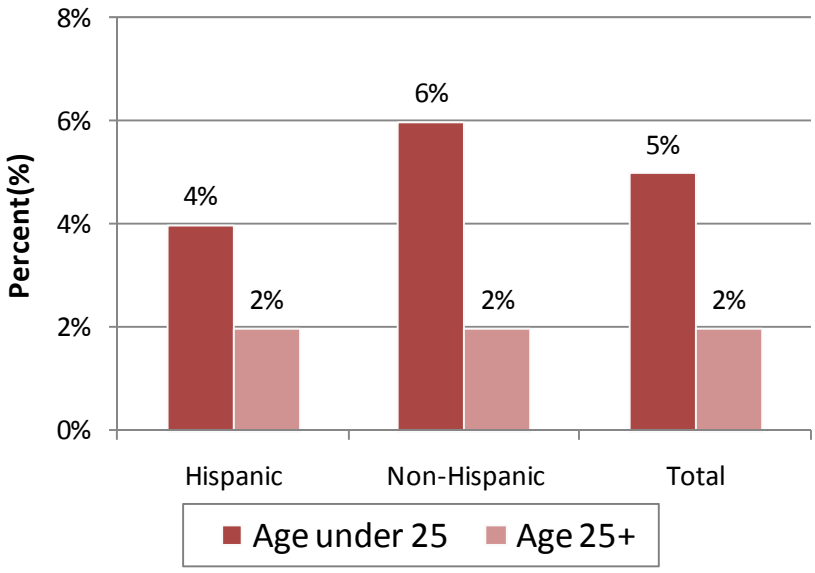


Figure 16. Percent of Pregnant Women Reporting Physical Abuse during Pregnancy by Ethnicity and Age, Colorado Residents, 2005-2008

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

The PRAMS survey asks women about possible risk factors for physical abuse. Risk factors include threats, fears for personal or family safety, excessive control of daily activities, and unwanted sexual activity. Among women experiencing any of these risk factors, 28 percent reported abuse during pregnancy (2004-2007). Among women without any risk factors, just 1 percent reported abuse. Also during the same time period, slightly less than half of pregnant women (47 percent) reported having a health care worker discuss physical abuse. Women who reported abuse or risk factors for abuse were no more likely to say that the subject was covered by a health care worker than women who did not report abuse or risk factors for abuse.

Section 3: Health-Related Behaviors

Certain behaviors result in major health consequences for both mother and infant, most notably: smoking, alcohol use, lack of stress management, inadequate or excessive weight gain, poor nutrition, and a lack of physical activity. As such, attempts should be made to modify these behaviors during prenatal period. The discussion below provides more information about each of these behaviors.

Smoking

Women who smoke during pregnancy are at risk for premature birth, pregnancy complications, low weight infants, stillbirth, and infant mortality.[22] In a 2000 study, smoking during pregnancy was found to be the second leading cause of low birth weight among singleton births in Colorado.[23] The prevalence of smoking among women who become pregnant has changed little since the year 2000.[24] According to PRAMS data, about 1 out of every 5 women identifies

as being a smoker prior to pregnancy (Figure 17). Healthy People 2010 Objective 16-17c proposes that 99 percent of pregnant women refrain from smoking during pregnancy. In addition, a new Healthy People 2020 objective (MICH HP2020-23) targets a reduction in postpartum relapse among smokers who quit during pregnancy.

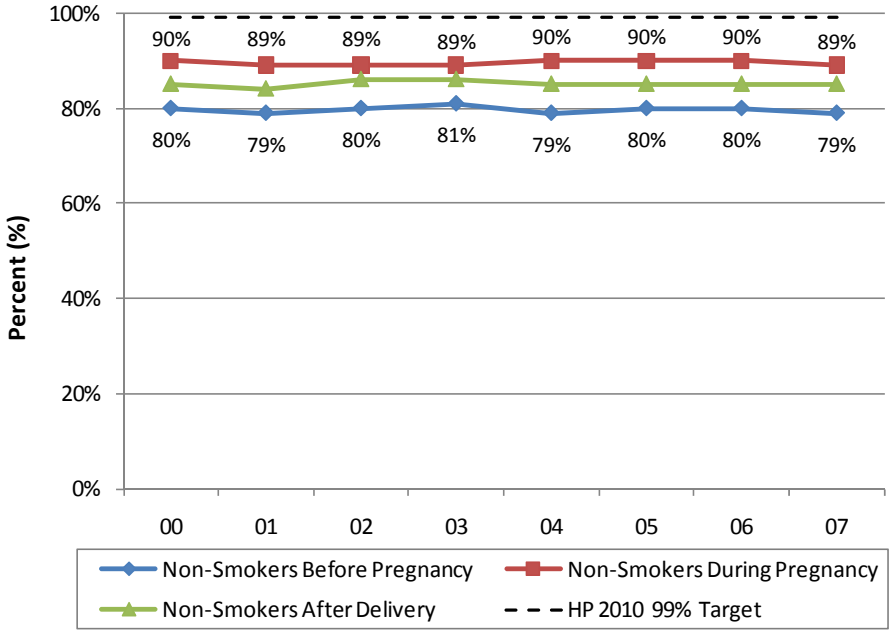


Figure 17. Percent Nonsmokers Before and During Pregnancy and After Delivery, Colorado Residents, 2000-2007

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

In a recent national review of smoking during pregnancy, 20.2 percent of women in Colorado were smoking before pregnancy in 2005, a percentage that was lower than some states and higher than others. Women in Utah had the lowest smoking rate; only 10 percent were smoking before pregnancy in 2005.[25] Many women (close to half) do quit smoking when they learn that they are pregnant, and the percentage of pregnant women who are nonsmokers increases to nearly 90 percent during pregnancy (Figure 17). Unfortunately, about half of women who quit smoking during pregnancy resume after delivery.

The prevalence of nonsmokers among women who give birth varies greatly by age. Figure 18 illustrates PRAMS data for 2004-2007, which shows the likelihood of being a non-smoker prior to pregnancy, quitting during pregnancy, and staying a non-smoker after pregnancy is higher among women ages 25 and older, and generally increases with age after 25 (Figure 18).

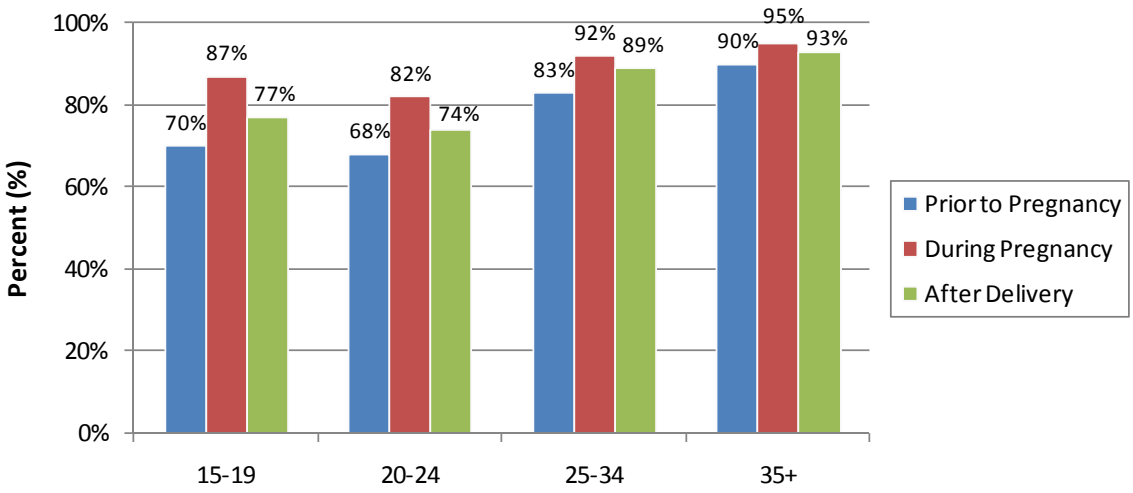


Figure 18. Percent Nonsmokers by Maternal Age and Pregnancy Status, Colorado Residents, 2004-2007

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Smoking prevalence among women who give birth also varies by race/ethnicity (Figure 19). According to PRAMS data (2004-2007), there were significantly more White/Hispanic nonsmokers before pregnancy compared to White/non-Hispanic women (87 percent compared to 76 percent).[xv] Quitting smoking during pregnancy is more common among White/non-Hispanic women, but resuming smoking is equally likely for women in both ethnic groups.

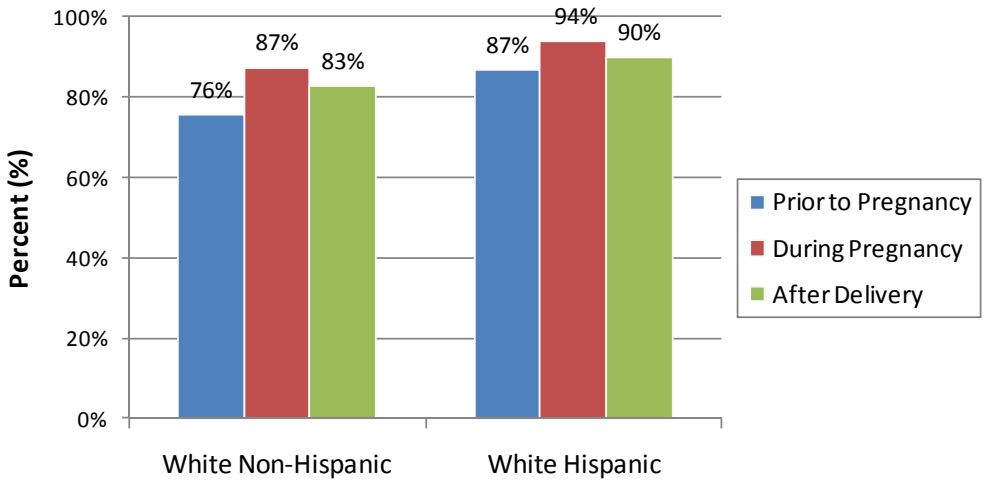


Figure 19. Percent Nonsmokers by Race/Ethnicity and Pregnancy Status, Colorado Residents, 2004-2007

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

[xv] "White/Hispanic" refers to women who are of White race and also Hispanic ethnicity. It excludes any Hispanic women categorized as other race. "White/non-Hispanic" refers to women who are of White race and are not of Hispanic ethnicity.

Smoking prevalence also varies widely by income (Figure 20). According to PRAMS data (2004-2007), women whose prenatal care was covered by Medicaid were significantly less likely to be nonsmokers compared to women whose prenatal care was covered by other sources (67 percent compared with 86 percent). Thirty-three percent of women on Medicaid were smokers prior to pregnancy, compared to 14 percent of non-Medicaid mothers. However, 42 percent of pregnant Medicaid women who smoked prior to pregnancy quit during pregnancy. After delivery, 74 percent of Medicaid women were nonsmokers compared to 91 percent of non-Medicaid women, an increase from pre-pregnancy rates for both groups.

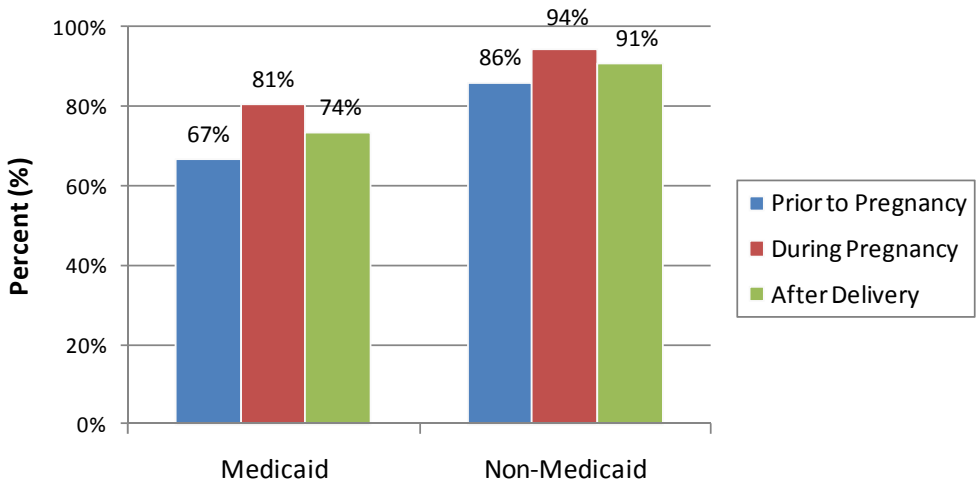


Figure 20. Percent Nonsmokers by Medicaid Status and Pregnancy Status, Colorado Residents, 2004-2007

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

A number of smokers reported that a health care worker talked to them during pregnancy about techniques to stop smoking including: pills, gum, the nicotine patch, or the state's QuitLine. According to Colorado PRAMS data (2005-2008) 47 percent of women who smoked before pregnancy reported such advice, while 60 percent of women who smoked during the last trimester reported such advice. A total of 54 percent of women who reported smoking after delivery also recalled such advice.

A further analysis of PRAMS data by age and race/ethnicity for 2005-2008 illustrates which smokers are most likely to quit during pregnancy and to remain non-smokers after delivery (Figure 21). For women younger than 25 years old, Hispanic women were more likely to quit and remain smoke free; nearly half (46 percent) of the smokers in this group remained smoke free compared to one-third (32 percent) of non-Hispanic women younger than 25 years old. Among older women, the same pattern prevailed but at lower rates: Hispanic smokers who quit were more likely to avoid relapse (36 percent) than non-Hispanic smokers who quit (28 percent).

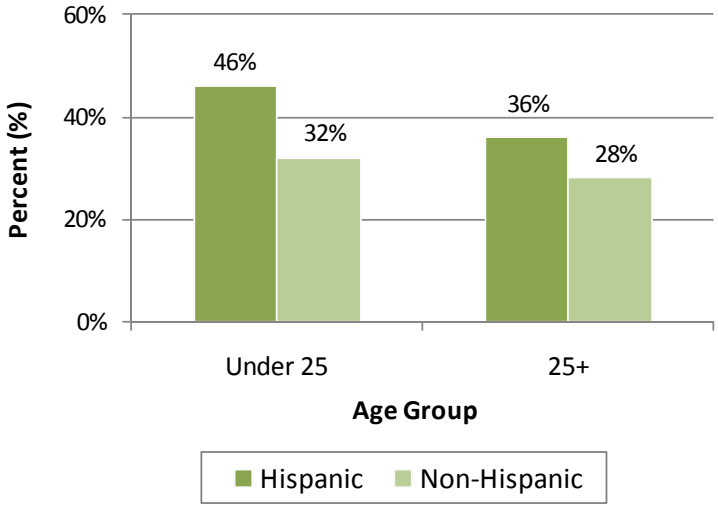


Figure 21. Percent of Pregnant Smokers Who Quit Smoking and Remain Nonsmokers after Delivery, by Age and Ethnicity, Colorado Residents, 2005-2008
Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Alcohol Use in Pregnancy

Alcohol use during early pregnancy can result in spontaneous abortion, behavioral and learning problems in children, fetal alcohol spectrum disorders, and low birth weight. Continued alcohol use throughout pregnancy can worsen these effects and result in preterm delivery. In 2005, the Surgeon General advised all pregnant women, as well as women who may become pregnant, to completely abstain from alcohol.[26] Healthy People 2010 Objective 16-17a proposes that at least 94 percent of pregnant women abstain from alcohol.

Alcohol usage by Colorado's pregnant women is slightly on the increase, and is apparently higher than other states. According to PRAMS data, 88 percent of women reported no alcohol use in the last trimester during 2007, compared to 91 percent in 2000 (although the trend is not statistically significant) (Figure 22). In a 2003 Centers for Disease Control and Prevention study, out of the 19 states that participate in PRAMS, Colorado had the highest alcohol usage rate of any of state. In fact, 16 states met the Healthy People 2010 target of 94 percent abstinence, while only Colorado, Florida and New York (excluding New York City) did not.[27]

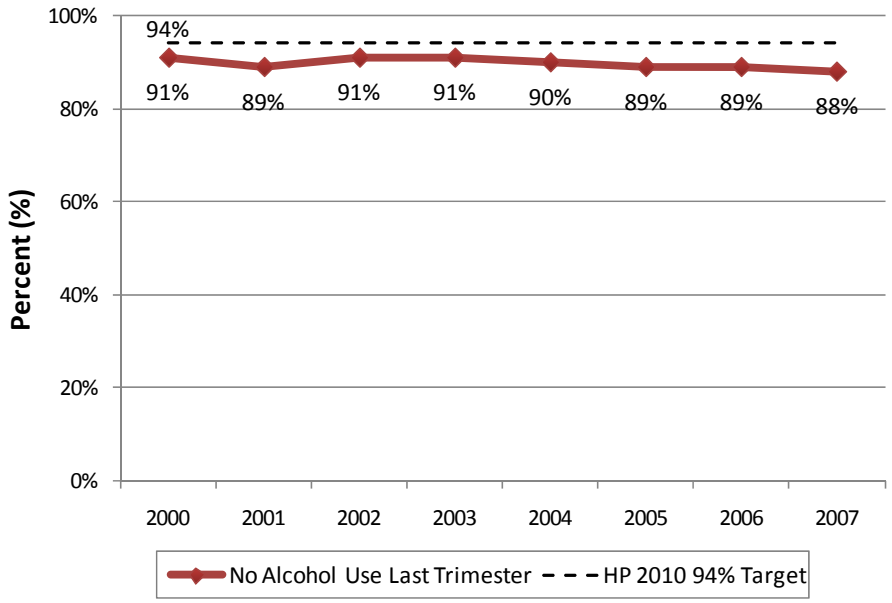


Figure 22. Percent of Pregnant Women Abstaining from Alcohol Use During the Third Trimester, Colorado Residents, 2000 to 2007

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Colorado PRAMS data for 2004-2007 show some important differences in alcohol usage by age. Ninety-seven percent of young, pregnant women (ages 15-19 years old) abstained from drinking alcohol, which is above Healthy People objective of 94 percent. Women ages 20-24 years old were close to meeting the target, while women ages 25 years and older had abstinence rates far below the target (Figure 23).

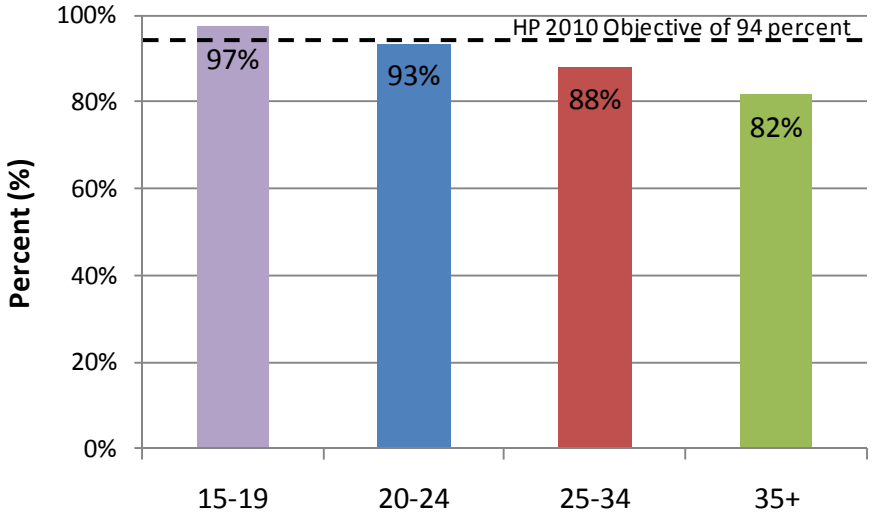


Figure 23. Percent of Pregnant Women Abstaining from Alcohol in the Third Trimester by Age, Colorado Residents, 2000 to 2007

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

PRAMS data also show that White/ Hispanic women were significantly more likely to be abstinent than White/non-Hispanic women, with 94 percent (meeting the target) reporting no use of alcohol in the last trimester, compared to 86 percent.[xvi] In addition, women whose prenatal care was paid for by Medicaid were much less likely to drink during pregnancy compared to women who were not covered by Medicaid. A total of 93 percent of women on Medicaid were abstinent in 2004-2007, while 87 percent of women not on Medicaid reported being abstinent, a difference which is statistically significant. Women on Medicaid also reported more often that a health care worker discussed the issue of drinking in pregnancy: 77 percent compared to 71 percent of women not on Medicaid (although this difference is not statistically significant). Finally, PRAMS data for 2007 show that among all women, 73 percent reported that a health care worker discussed alcohol, a significantly lower percentage than in 1999, when 81 percent reported such a discussion.

Stress

The effects of stress on pregnancy are becoming increasingly clear, with a growing body of research showing that preterm birth and low birth weight can be related to stress both before and during pregnancy.[28-32] Stress increases a corticotrophin-releasing hormone (CRH) into the blood which increases prostaglandins which can in turn trigger uterine contractions and labor. Stress appears to be related to racial discrimination, demanding working environments, living in "high-deprivation" neighborhoods, and other highly individual factors. Stress can also lead to destructive behaviors such as smoking, drinking, and drug use.[28-32]

The PRAMS survey asks a number of questions about stress, and the responses are typically grouped according to the number of stressors a woman reports. Thirteen stressors are named, including the death of someone close, separation, divorce, moving, job loss, financial problems, jail, alcohol or drug abuse, and physical fighting. The number of stressors by age group is provided in Table 9. A higher percentage of younger women have more stressors than older women, with an average of 2.5 stressors for younger women (ages 15-24), compared to 1.4 for older women (ages 25 and older), a statistically significant difference.

Table 9: Percent of Pregnant Women Experiencing Stress, by Age Group, Colorado Residents, 2005-2008

Number of Stressors	Age Group of Pregnant Women	
	15-24	25+
3 or more	40%	22%
1 or 2	39%	44%
None	20%	35%

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

[xvi] In this discussion, "White/Hispanic" refers to women categorized as both White race and Hispanic ethnicity. It excludes any Hispanic women categorized as other race. "White/Non-Hispanic" refers to women who are both White race and non-Hispanic ethnicity. It excludes non-Hispanic women who are not also White.

When grouped by federal poverty levels, the variation in the number of stressors among pregnant women is fairly pronounced (Table 10). In fact, the differences are statistically significantly for those with three or more stressors, and also for those with none.

Table 10. Percent of Pregnant Women Experiencing Stress Grouped by Poverty Level, Colorado Residents, 2005-2008

Number of Stressors	Federal Poverty Level	
	At or below 200%	Above 200%
3 or more	37%	16%
1 or 2	42%	43%
None	22%	41%

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Stress is highly related to a number of other risk factors. Twenty-seven percent of all pregnant women report 3 or more stressors in the 12 months prior to delivery. In contrast, 89 percent of pregnant women who were physically abused report 3 or more stressors. Among women who smoked during pregnancy, 52 percent reported 3 or more stressors. Among women with an unintended pregnancy, 40 percent reported 3 or more stressors (Figure 24).

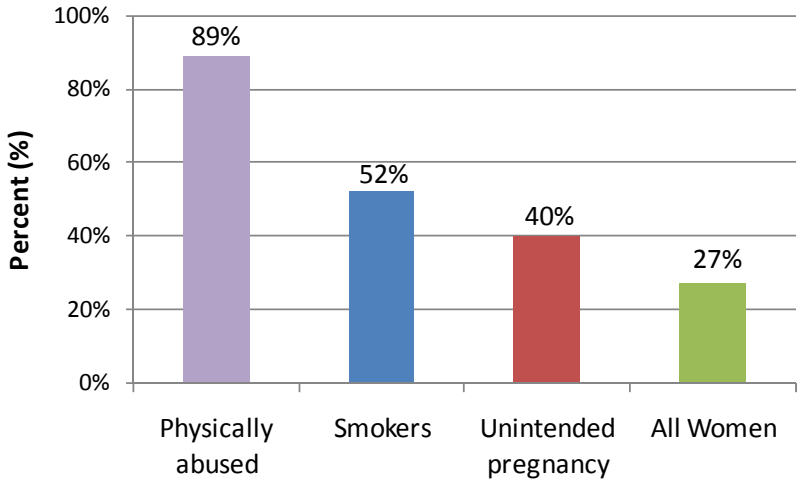


Figure 24. Percent of Pregnant Women Reporting 3 or More Stressors in the 12 Months Prior to Delivery, by Specified Risk Factors, Colorado Residents, 2005-2008

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Weight Gain during Pregnancy

Guidelines for weight gain during pregnancy are defined by the Institute of Medicine, and categorized as adequate, inadequate, or excessive. Each category is determined by the body mass index (BMI) of the woman prior to pregnancy. Based on the guidelines from 1990 that were available at the time that these data were analyzed, the recommended amount of weight to gain during pregnancy was 28-40 pounds for an underweight woman, 25-35 pounds for a normal weight woman, 15-25 pounds for an overweight woman, and 15 pounds for an obese

woman.[xvii] There is a new weight gain objective in Healthy People 2020 (MICH HP2020-17) to increase the proportion of mothers who achieve their recommended weight gain during pregnancy. During 2004-2008, only about 30 percent of women in Colorado gained an appropriate amount of weight during pregnancy, according to PRAMS data. Twenty four percent gained too little weight and 46 percent gained too much as defined by the Institute of Medicine.

Inadequate Weight Gain

The birth weight of the infant is correlated with the weight gain of the mother. A 2000 Colorado study entitled *Tipping the Scales: Weighing in on Solutions to the Low Birth Weight Problem in Colorado,*[23] determined that women who failed to gain enough weight during pregnancy were 1.6 times more likely to have a low birth weight infant than women who gained adequate weight. PRAMS data show that close to 1 in every 5 pregnant women do not gain enough weight which contributes to about 1 out of every 8 low birth weight infants.

Inadequate weight gain is more common among low-income women. For the period 2004-2008, 27 percent of women on Medicaid experienced inadequate weight gain, compared to 23 percent of women not covered by Medicaid, a difference that is significant. However, this issue affects women of all ages, educational levels, and racial and ethnic groups: Figure 25 shows that at least 1 in 4 to 5 women in any group gains inadequately.

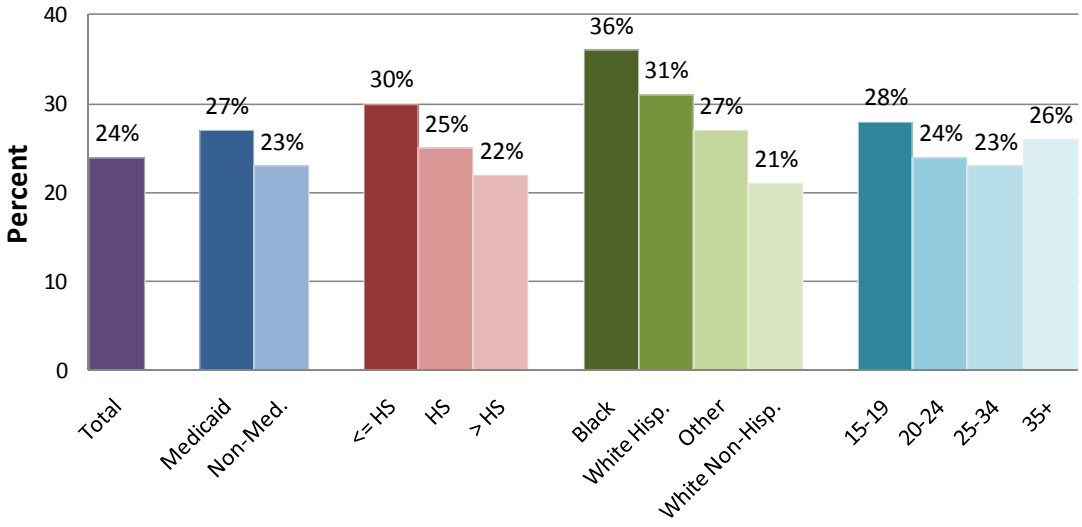


Figure 25. Percent of Pregnant Women Gaining an Inadequate Amount of Weight by Medicaid Status, Education, Race/Ethnicity, and Age Group, Colorado Residents, 2004-2008
Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

Groups of women most at risk of gaining too little weight are as follows: women who have Medicaid during pregnancy; women with less than a high school education; women of color;

[xvii] The Institute of Medicine guidelines in this section of the report are from 1990. New guidelines, which differ slightly, were issued in 2009.[33]

and women younger than 20 years old. In Figure 25, the percentage of the women in these subgroups approached or exceeded 30 percent.

Excessive Weight Gain during Pregnancy

Excessive weight gain during pregnancy is associated with gestational diabetes, pregnancy-associated hypertension (including preeclampsia and eclampsia), increased risks of preterm delivery, cesarean section, difficulty with breastfeeding, and weight retention after delivery.[33]

According to birth certificate data for women delivering singletons during 2007-2008, about half (51 percent) of those who gained too much weight during pregnancy were overweight or obese before pregnancy, based on their BMI recorded on the birth certificate. (The remaining half of pregnant women who gained too much weight during pregnancy were in the normal or underweight BMI range at conception). Excessive weight gain varies little among subgroups of women defined by race/ethnicity, age, or education. However, according to PRAMS data (2007-2008) nearly half (47 percent) of the pregnant women on Medicaid gained too much weight.

Counseling by a medical provider on appropriate weight gain during pregnancy is an important aspect of prenatal care. According to Colorado PRAMS (2005-2008), one-third of pregnant women reported that they were not told how much weight to gain by a health care provider.

Adequate/Recommended Weight Gain

Just 3 in 10 Colorado women (29.9 percent) gain weight according to the IOM guidelines (birth certificate data, 2007-2008). Figure 26 shows the differences by age, and racial and ethnic groups.[xviii] Women ages 25 and older were significantly more likely to gain an adequate amount of weight (31.0 percent) compared to women younger than 25 years old (27.6 percent).

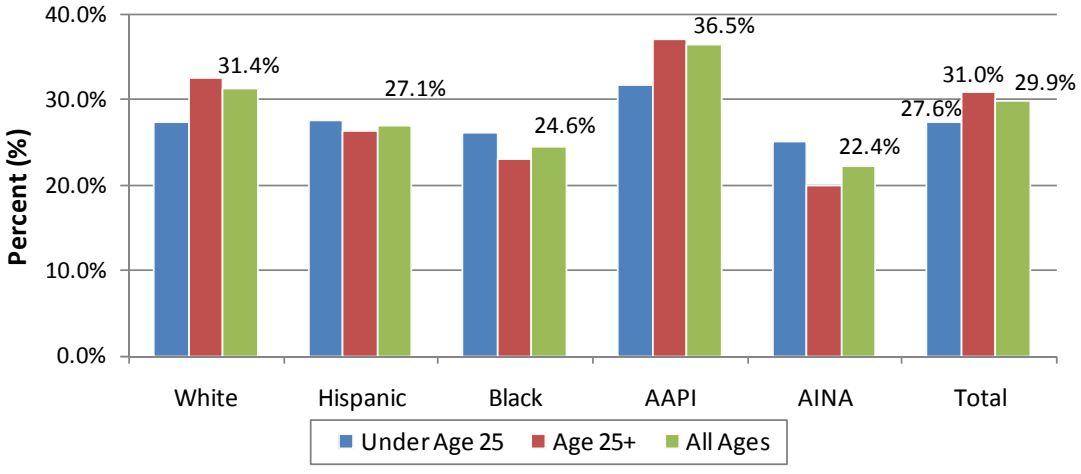


Figure 26. Percent of Pregnant Women Gaining Adequate Weight during Pregnancy By Race/Ethnicity and Age, Colorado Residents, 2007-2008

Source: Colorado Department of Public Health and Environment, Birth Certificate Data

[xviii] In the accompanying figure, "White" includes all White women of either ethnicity (Hispanic and non-Hispanic), "Hispanic" includes all Hispanic women of any race (White, Black, other, etc.), and the other racial groups include all women of either ethnicity.

Asian American/Pacific Islander (AAPI) women were the most likely to gain an adequate amount of weight at 36.5 percent. This is a statistically significant difference compared to women of all other racial and ethnic backgrounds. White/non-Hispanic women were the next largest group, with 31.4 percent gaining weight adequately. The group least likely to gain adequate weight was American Indian/Native Alaskan women (AINA) at 22.4 percent.

Women's Weight Prior to Pregnancy

In Colorado, the percentage of women who were overweight or obese before becoming pregnant has increased over the past 11 years. In 1998, 9 percent of women were overweight and 14 percent were obese, increasing to 14 percent and 18 percent respectively, by 2008 (Figure 27). Over this entire period, there is a statistically significant linear increasing trend in overweight and obese mothers as well as a decrease in underweight mothers.

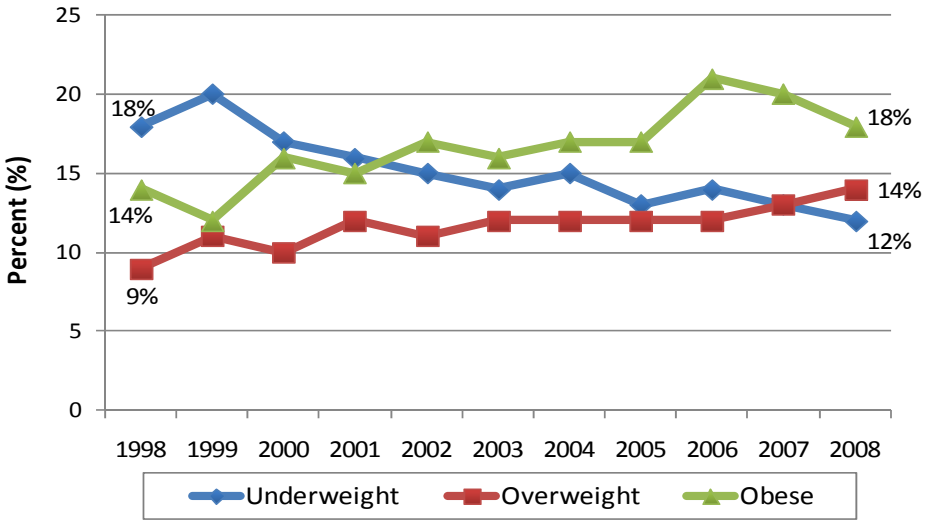


Figure 27. Percent of Pregnant Women by BMI Category at Start of Pregnancy, Colorado Residents, 1998-2008

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

As pre-pregnancy weight increases, so does the proportion of women who gain too much weight. This pattern is of particular concern, given the trend in the proportion of women who are overweight or obese prior to pregnancy (Figure 27). Figure 28 illustrates the magnitude of weight gained during pregnancy (according to IOM guidelines), based on whether the women's BMI placed her in the category of underweight, normal weight, overweight or obese, prior to pregnancy. The figure illustrates the correlation between weight prior to pregnancy and excessive weight gain for Colorado women during 2007-2008.

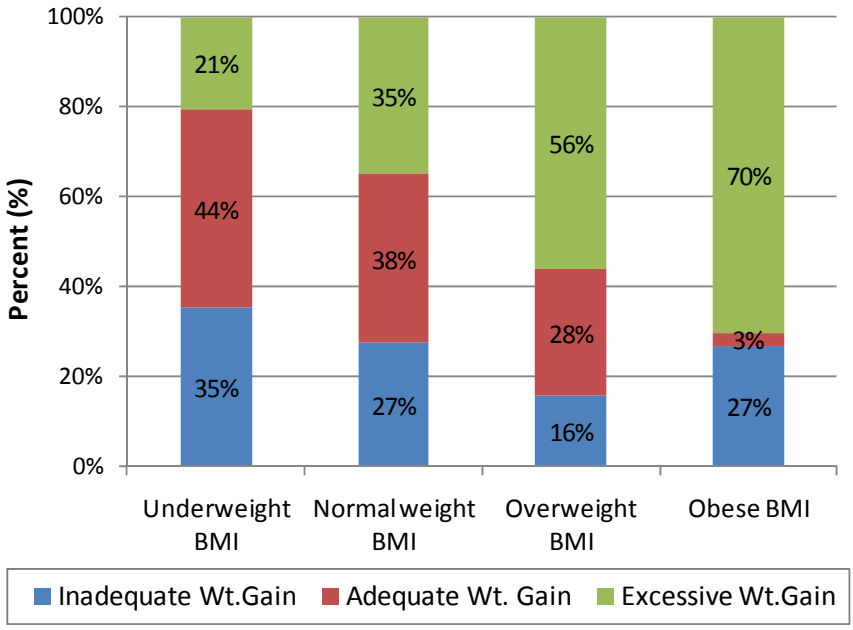


Figure 28. Maternal Weight Gain During Pregnancy by Prepregnancy BMI Colorado Residents, 2007-2008

Source: Colorado Department of Public Health and Environment, Birth Certificate Data

Fruit and Vegetable Intake

Healthy People 2010 and 2020 have the same objectives regarding fruit and vegetable intake for the general population, which also applies to pregnant women. This includes the consumption of two daily servings of fruit and three daily servings of vegetables. According to 2004-2007 Colorado PRAMS data, the recommended target of five fruits and vegetables daily was met by just 12 percent of women (eating patterns were reported during the last three months of pregnancy). There was little difference by age: 15 percent of women younger than 20 years old reported eating the recommended number, 11 percent of women ages 20-34 years did so, and 13 percent of women age 35 years and older consumed five or more. In addition, no significant differences were found between Hispanic and non-Hispanic women. It may be worth noting that in 2007, ten percent of all women who gave birth reported that they ate less food than they felt they should overall, because they did not have enough money to buy food. This may indicate a barrier to purchasing adequate amounts of fruits and vegetables (PRAMS, 2007).

Physical Activity

The research on physical activity among pregnant women indicates that light-to-moderate physical activity for women, in the absence of certain risk factors, has positive health effects for both the mother and infant. During pregnancy, exercise reduces and prevents back pain, reduces retention of liquid, reduces cardiovascular stress, increases oxygenation capacity, decreases blood pressure, reduces the risk of gestational diabetes, prevents thromboses and varicose veins, and helps control maternal weight gain.[34] One study reports that even vigorous physical activity is associated with a reduced rate of preterm birth.[35]

Figure 29 illustrates exercise frequency in the last trimester of pregnancy, among all Colorado women who delivered their baby during 2005-2008, and among subgroups defined by their pre-pregnancy weight. (Excluded from the results are women who were advised not to exercise by their health care worker.) In general, 30 percent of women exercised less than one day per week, 53 percent exercised 1 to 4 days per week, and 17 percent exercised more than 5 days per week. Healthy People 2010 Objective 22-1 proposes that 30 percent of adults (baseline 15 percent) exercise moderately for 30 minutes a day.[xix] There was an inverse association between pre-pregnancy weight and the typical number of days per week that women exercised during the third trimester: overweight and obese women were the least likely to exercise more often.

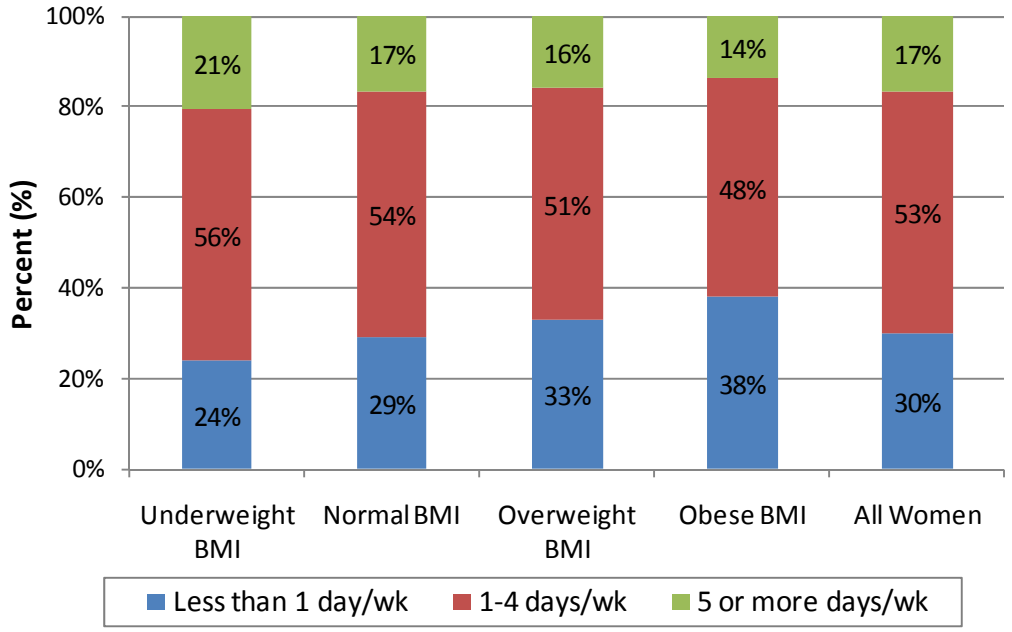


Figure 29. Frequency of Exercise and the Percent of Pregnant Women Exercising in the Last Trimester by their Pre-pregnancy BMI, Colorado Residents, 2005-2008

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment Monitoring System

[xix] The Healthy People 2020 objectives no longer focus on moderate levels of physical activity, but rather focus on reducing the number of adults who do not exercise at all (PAF HP2020-1), and increasing the numbers who walk (PAF HP2020-10) or bike (PAF HP2020-11). No Healthy People objectives specify desired levels of physical activity for pregnant women.

References

1. Halfon N, Hochstein M. Life course health development: an integrated framework for developing health, policy, and research. *Milbank Q.* 2002;80(3):433-79, iii.
2. Martin JA, Hamilton BE, Sutton PD, Ventura SJ, Menacker F, Munson ML. Births: final data for 2002. *Natl Vital Stat Rep.* 2003;52(10):1-113.
3. Martin JA, Hamilton BE, Sutton PD, et al. Births: final data for 2006. *Natl Vital Stat Rep.* 2009;57(7):1-102.
4. Kotelchuck M. Overview of Adequacy of Prenatal Care Utilization Index. Available at: http://www.mchlibrary.info/databases/HSNRCPDFs/Overview_APCUIndex.pdf. Accessed December 2009.
5. U.S. Department of Health and Human Services. Healthy People 2010. U.S. Government Printing Office. 2000.
6. Jeffcoat MK, Geurs NC, Reddy MS, Cliver SP, Goldenberg RL, Hauth JC. Periodontal infection and preterm birth: results of a prospective study. *J Am Dent Assoc.* 2001;132(7):875-80.
7. Boggess KA, Lieff S, Murtha AP, Moss K, Beck J, Offenbacher S. Maternal periodontal disease is associated with an increased risk for preeclampsia. *Obstet Gynecol.* 2003;101(2):227-31.
8. Offenbacher S, Katz V, Fertik G, et al. Periodontal infection as a possible risk factor for preterm low birth weight. *J Periodontol.* 1996;67(10 Suppl):1103-13.
9. Offenbacher S, Beck JD. Periodontitis: a potential risk factor for spontaneous preterm birth. *Compend Contin Educ Dent.* 2001;22(2 Spec No):17-20.
10. Dasanayake AP. Poor periodontal health of the pregnant woman as a risk factor for low birth weight. *Ann Periodontol.* 1998;3(1):206-12.
11. Dye BA, Tan S, Smith V, et al. Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Stat 11.* 2007(248):1-92.
12. Correa A, Gilboa SM, Besser LM, et al. Diabetes mellitus and birth defects. *Am J Obstet Gynecol.* 2008;199(3):237 e1-9.
13. Metzger BE, Buchanan TA, Coustan DR, et al. Summary and recommendations of the Fifth International Workshop-Conference on Gestational Diabetes Mellitus. *Diabetes Care.* 2007;30 Suppl 2:S251-60.
14. Hauth JC, Ewell MG, Levine RJ, et al. Pregnancy outcomes in healthy nulliparas who developed hypertension. Calcium for Preeclampsia Prevention Study Group. *Obstet Gynecol.* 2000;95(1):24-8.
15. Wilson BJ, Watson MS, Prescott GJ, et al. Hypertensive diseases of pregnancy and risk of hypertension and stroke in later life: results from cohort study. *BMJ.* 2003;326(7394):845.
16. Report of the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy. *Am J Obstet Gynecol.* 2000;183(1):S1-S22.
17. Fang J, Madhavan S, Alderman MH. The influence of maternal hypertension on low birth weight: differences among ethnic populations. *Ethn Dis.* 1999;9(3):369-76.
18. Villar J, Carroli G, Wojdyla D, et al. Preeclampsia, gestational hypertension and intrauterine growth restriction, related or independent conditions? *Am J Obstet Gynecol.* 2006;194(4):921-31.
19. Brown HL. Trauma in pregnancy. *Obstet Gynecol.* 2009;114(1):147-60.
20. Sirin H, Weiss HB, Sauber-Schatz EK, Dunning K. Seat belt use, counseling and motor-vehicle injury during pregnancy: results from a multi-state population-based survey. *Matern Child Health J.* 2007;11(5):505-10.

21. Klinich KD, Flannagan CA, Rupp JD, Sochor M, Schneider LW, Pearlman MD. Fetal outcome in motor-vehicle crashes: effects of crash characteristics and maternal restraint. *Am J Obstet Gynecol.* 2008;198(4):450 e1-9.
22. Centers for Disease Control. Highlights: Health Consequence of Tobacco Use Among Women. Available at: http://www.cdc.gov/tobacco/data_statistics/sgr/2001/highlights/consequences/index.htm. Accessed January 2010.
23. Ricketts S, Trierweiler K. Tipping the scales : weighing in on solutions to the low birth weight problem in Colorado. Denver, CO: Colorado Dept. of Public Health & Environment; 2000.
24. Bukulski M, Osborne D, Ricketts S, Tolliver R. Smoking Before, During and After Pregnancy: Colorado Trends. *Health Watch.* 2010(75):1-6.
25. Tong VT, Jones JR, Dietz PM, D'Angelo D, Bombard JM. Trends in smoking before, during, and after pregnancy - Pregnancy Risk Assessment Monitoring System (PRAMS), United States, 31 sites, 2000-2005. *MMWR Surveill Summ.* 2009;58(4):1-29.
26. Office of the Surgeon General. News Release: U.S. Surgeon General Releases Advisory on Alcohol Use in Pregnancy. U.S. Department of Health & Human Services. 2005.
27. Suellentrop K, Morrow B, Williams L, D'Angelo D. Monitoring progress toward achieving Maternal and Infant Healthy People 2010 objectives--19 states, Pregnancy Risk Assessment Monitoring System (PRAMS), 2000-2003. *MMWR Surveill Summ.* 2006;55(9):1-11.
28. Collins JW, Jr., David RJ, Symons R, Handler A, Wall S, Andes S. African-American mothers' perception of their residential environment, stressful life events, and very low birthweight. *Epidemiology.* 1998;9(3):286-9.
29. Holzman C, Jetton J, Siler-Khodr T, Fisher R, Rip T. Second trimester corticotropin-releasing hormone levels in relation to preterm delivery and ethnicity. *Obstet Gynecol.* 2001;97(5 Pt 1):657-63.
30. Holzman C, Eyster J, Kleyn M, et al. Maternal weathering and risk of preterm delivery. *Am J Public Health.* 2009;99(10):1864-71.
31. McCubbin JA, Lawson EJ, Cox S, Sherman JJ, Norton JA, Read JA. Prenatal maternal blood pressure response to stress predicts birth weight and gestational age: a preliminary study. *Am J Obstet Gynecol.* 1996;175(3 Pt 1):706-12.
32. Vrijkotte TG, van der Wal MF, van Eijsden M, Bonsel GJ. First-trimester working conditions and birthweight: a prospective cohort study. *Am J Public Health.* 2009;99(8):1409-16.
33. Rasmussen KM, Yaktine AL, Institute of Medicine (U.S.). Committee to Reexamine IOM Pregnancy Weight Guidelines. Weight gain during pregnancy : reexamining the guidelines. Washington, DC: National Academies Press; 2009.
34. Schlussel MM, Souza EB, Reichenheim ME, Kac G. Physical activity during pregnancy and maternal-child health outcomes: a systematic literature review. *Cad. Saude Publica.* 2008;24 Suppl 4:s531-44.
35. Evenson KR, Siega-Riz AM, Savitz DA, Leiferman JA, Thorp JM, Jr. Vigorous leisure activity and pregnancy outcome. *Epidemiology.* 2002;13(6):653-9.